

DOES US FOREIGN AID FOSTER INNOVATION IN RECIPIENT
COUNTRIES?

by
Angelina H. Boampong

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Abstract

Previous works studied the impact of foreign aid on economic growth with mixed results. US foreign aid promotes peace, security, and economic development, and provides humanitarian relief. These factors also spur innovation so it is assumed that foreign aid also fuels innovation. This study examines if US foreign aid impacts innovation in 146 recipient countries from 2011 to 2017. The study leverages fixed effects and ordinary least square regressions to assess the relationship between US foreign aid and innovation, while controlling for GDP, population size, and geographical region. The results of the analysis show that US foreign aid has a negative impact on innovation input factors for countries in Europe and Eurasia. GDP and population size were found to have measurable impacts on innovation under various scenarios. The results will provide useful insight in future considerations about how and when the US provides aid to other countries.

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1 Introduction

The United States has a long history of providing aid to other countries dating as far back as 1945. For example, the US was a key provider of aid to Europe to spur redevelopment after the second world war. In 1961, the Foreign Assistance Act¹ was enacted to consolidate and formalize various separate programs under US law. Since then US policy has changed several times to provide foreign aid for various purposes including protecting and expanding US interests, supporting basic human rights and development, and fostering economic development and self-sufficiency.² Today, the US Department of State describes the key strategic, economic, and moral imperative goals of foreign aid as aiding other countries to support global peace, security, and development efforts, and provide humanitarian relief during times of crisis.³

In the early days of the Trump administration, foreign aid took center-stage as a potential area where funding would be reduced as part of the administration's America First policy.⁴ Under the proposal, US foreign aid would have been reduced by 37%⁵, spurring discussion about how much of the US budget is dedicated to foreign aid.

¹ USAID, "The Foreign Assistance Act of 1961, as Amended: Legislation on Foreign Relations Through 2002", *Volume I-A of Volumes I-A and I-B*, (2003), <https://www.usaid.gov/ads/policy/faa>.

² USAID, "USAID History", updated February 16, 2018, <https://www.usaid.gov/who-we-are/usaaid-history> (accessed September 12, 2018).

³ US Department of State, "What is U.S. Government Foreign Assistance?" <https://www.foreignassistance.gov/> (accessed September 12, 2018).

⁴ The White House "America First: A Budget Blueprint to Make America Great Again", https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/budget/fy2018/2018_blueprint.pdf (accessed September 12, 2018).

⁵ Ferrarello, M., "What America First Means for US Foreign Aid. Brookings Now", (2017), <https://www.brookings.edu/blog/brookings-now/2017/07/27/what-america-first-means-for-us-foreign-aid/> (accessed September 12, 2018).

Currently, foreign aid represents less than 1% of the US budget.⁶ The importance and efficacy of US foreign aid has also been brought into question by the Trump administration.⁷

Previous works have studied the impact of foreign aid on economic growth with mixed results. As mentioned earlier, US foreign aid promotes peace, security, and economic development, and provides humanitarian relief. These factors also spur innovation. It is therefore reasonable to expect that increased innovation would also be a bi-product of foreign aid. The relationship between foreign aid and innovation has not been previously examined. This study examines if US foreign aid impacts innovation in 146 recipient countries from 2011 to 2017. The study leverages fixed effects and ordinary least square regressions to assess the relationship between US foreign aid and innovation, while controlling for GDP, population size, and geographical region. The results of the analysis show that US foreign aid has a negative impact on innovation input factors for countries in Europe and Eurasia. In other regions, US foreign aid was found to have no significant effect on innovation. GDP and population size were however found to have measurable impacts on innovation under various scenarios. The results add to the literature on the effects on foreign aid and will provide useful insight in future considerations about how and when the US provides aid to other countries. This study also serves as a stepping-stone for future research on related topics.

⁶ USAID, “Dollars to Results: USAID Investments and Illustrative Results”, <https://results.usaid.gov/results> (accessed September 12, 2018).

⁷ Ferrarello, M., “What America First Means for US Foreign Aid. Brookings Now”, (2017), <https://www.brookings.edu/blog/brookings-now/2017/07/27/what-america-first-means-for-us-foreign-aid/> (accessed September 12, 2018).

2 Literature Review and Theoretical Framework

2.1 US Foreign Aid

The United States has a long history of providing aid to other countries dating as far back as 1945. For example, the US was a key provider of aid to Europe to spur redevelopment after the second world war. In 1961, the Foreign Assistance Act⁸ was enacted to consolidate and formalize various separate programs under US law. Since then US policy has changed several times to provide foreign aid for various purposes including protecting and expanding US interests, supporting basic human rights and development, and fostering economic development and self-sufficiency.⁹ Today, the US Department of State describes the key strategic, economic, and moral imperative goals of foreign aid as aiding other countries to support global peace, security, and development efforts, and provide humanitarian relief during times of crisis.¹⁰

Currently, the US spends about 1% of the federal budget on foreign aid to over 140 countries, and spans across 29 sectors including business and education.¹¹ Some of the better known successes of foreign aid in the past 20-40 years include the eradication of small pox, reduction of polio, infant mortality and extreme poverty.¹²

⁸ USAID, “The Foreign Assistance Act of 1961, as Amended: Legislation on Foreign Relations Through 2002”, *Volume I-A of Volumes I-A and I-B*, (2003), <https://www.usaid.gov/ads/policy/faa>.

⁹ USAID, “USAID History”, updated February 16, 2018, <https://www.usaid.gov/who-we-are/usaaid-history> (accessed September 12, 2018).

¹⁰ US Department of State, “What is U.S. Government Foreign Assistance?” <https://www.foreignassistance.gov/> (accessed September 12, 2018).

¹¹ USAID, “Dollars to Results: USAID Investments and Illustrative Results”, <https://results.usaid.gov/results> (accessed September 12, 2018).

¹² Ferrarello, M., “What America First Means for US Foreign Aid. Brookings Now”, (2017), <https://www.brookings.edu/blog/brookings-now/2017/07/27/what-america-first-means-for-us-foreign-aid/> (accessed September 12, 2018).

2.2 Innovation

According to the Merriam-Webster dictionary, Innovation is 1) a new idea, device, or method; 2) the act or process of introducing new ideas, devices or methods. In a business context, the end result is the creation of value. Nations recognize innovation as a necessary contributor to economic growth, competitive advantage, and their very survival. This has led to the evolution of heterogeneous systems of innovation at national, regional and local levels.¹³ The concept of innovation at the national level is now well established and often evaluated to determine how well nations are performing in the quest for high levels of innovativeness.

2.2.1. National Innovation Systems

A national innovation system consists of interdependent public and private institutions in various sectors whose interactions initiate and sustain innovation activities and outputs. The term national innovation system is referenced across literature starting in the 1980s.¹⁴ Since then, many studies have been published, which discuss the components, practices and indicators of national innovation systems, and evaluate and address related issues at the national level. Notable studies addressing the theories, frameworks and information flows in national innovation systems include those by the Organisation for Economic Co-operation¹⁵ and Bengt-Åke, L.¹⁶

¹⁴ Godin, B., “National Innovation System: The System Approach in Historical Perspective”, *Science, Technology, & Human Values*, Vol 34, Issue 4, (2009). pp. 476 – 501.

¹⁵ Organisation for Economic Co-operation, “National Innovation Systems”, <http://www.oecd.org/science/inno/2101733.pdf> (accessed October 1, 2018).

¹⁶ Bengt-Åke, L., “National Innovation Systems - Analytical Concept and Development Tool” *Industry and Innovation; Sydney* Vol. 14, Iss. 1 (2007).

Another notable national innovation framework is the Global Innovation Index.¹⁷ Work has also been done to study innovation systems in specific countries e.g. Korea¹⁸, India¹⁹, and the US²⁰.

Comparative analyses of innovation systems across countries and various sub-groupings have also been conducted e.g. across countries of varying income levels²¹ or by geography - Asia Pacific countries²², EU countries (European Innovation Scoreboard)²³. Both the Organisation for Economic Co-operation (OECD) and the Global Innovation Index provide comprehensive comparative analyses across a wide range of countries around the globe.

2.2.2. Factors Influencing Innovation at the National Level

A review of the frameworks cited above shows that many factors influence the ability to innovate. They agree on several broad categories like education, R&D investment, and innovation linkages among institutions and people. There are, however, also many differences both at the macro and micro levels.

¹⁷ Dutta, S., Lanvin, B., Wunsch-Vincent, S., “The Global Innovation Index 2018: Energizing the World with Innovation”, *Cornell University, INSEAD, World Intellectual Property Organization*, (2018).

¹⁸ Kim, L. Nelson, R., Nelson, R., “Technology, Learning, and Innovation: Experiences of Newly Industrializing Economies”. *Cambridge University Press* (2000).

¹⁹ Herstatt, C., Tiwari, R., Buse, S. Ernst, D., “India's National Innovation System: Key Elements and Corporate Perspectives”, *East-West Center Working Paper* (2008).

²⁰ Mowery, D., “The U.S. National Innovation System: Origins and Prospects for Change”, *Science and Technology Policy in Interdependent Economies*, Springer, Dordrecht (1994).

²¹ Nelson, R., “National Innovation Systems; A Comparative Analysis”, *Oxford University Press*, (1993).

²² Clarke T., Chelliah J., Pattinson E., “National Innovation Systems in the Asia Pacific: A Comparative Analysis”, *Innovation in the Asia Pacific*, Springer, Singapore (2018).

²³ European Commission, “European Innovation Scoreboard”, (2018).
http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en (accessed October 1, 2018).

For example, under the education category, both the European Innovation Scoreboard²⁴ and the Global Innovation Index²⁵ include indicators of tertiary education. One difference is that the European Innovation Scoreboard includes a measure of lifelong learning while the Global Innovation Index factors in secondary education and overall expenditure on education. Another difference is that the European Innovation Scoreboard considers sales impacts as a factor influencing innovation, while the Global Innovation Index does not. Rather, it includes a rating of the political climate which the European Innovation Scoreboard does not have. There are many more examples of variability across various works included in this review.

2.2.3. Measuring Innovation using the Global Innovation Index

The Global Innovation Index will be used extensively in this study as it provides a broad range of factors and micro-indicators applicable to a wide variety of countries regardless of economic status, geographical location, size, etc. The effect of foreign aid on these indicators can be evaluated and the results extended to the larger concept of innovation.

The Global Innovation Index describes a framework for national innovation systems, which goes beyond simply counting R&D-related funding and resulting products. It characterizes the framework as consisting of key enablers of innovation activity, the innovation activities themselves, and the related outputs.

²⁴ European Commission, “European Innovation Scoreboard”, (2018).
http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en (accessed October 1, 2018)

²⁵ Dutta, S., Lanvin, B., Wunsch-Vincent, S., “The Global Innovation Index 2018: Energizing the World with Innovation”, *Cornell University, INSEAD, World Intellectual Property Organization*, (2018).

The 5 key enablers are ²⁶:

- Institutions – political, regulatory and business environments
- Human Capital and Research – education, research & development (R&D)
- Infrastructure - Information and communication technologies (ICTs), general infrastructure, ecological sustainability
- Market Sophistication – credit, investment, trade, competition & market scale
- Business Sophistication – knowledge workers, innovation linkages, knowledge absorption

The main outputs of innovation activities are:

- Knowledge and Technology Outputs - Knowledge creation, impact and diffusion
- Creative Outputs - Intangible assets, creative goods and services, online creativity

2.3 Effects of Foreign Aid on Innovation

The enablers of innovation all require significant levels of sustained funding and development to ensure national environments are conducive to innovation activity. While to date, studies have not evaluated the impact of foreign aid on innovation, many studies have investigated the impact of foreign aid on economic growth (Gross Domestic Product) in recipient countries. Economic growth and innovation share many of the same enablers. Past studies on the effects of foreign aid on economic growth have shown mixed results. For example, Durberry, R. et al²⁷ showed a positive impact of foreign aid on economic growth in countries with stable regulatory environments.

²⁶ Dutta, S., Lanvin, B., Wunsch-Vincent, S., “The Global Innovation Index 2018: Energizing the World with Innovation”, *Cornell University, INSEAD, World Intellectual Property Organization*, (2018).

²⁷ Durberry, R., Gemmell, N., Greenaway, D., “New Evidence on the Impact of Foreign Aid on Economic Growth”, (1998). *CREDIT Research Paper, No. 98/8*, The University of Nottingham, Centre for Research in Economic Development and International Trade (CREDIT), Nottingham.

Ekanayake, E. & Chatrna, D.²⁸ had mixed results in their analysis of the impact of foreign aid on economic growth in some developing countries. Mallik, G.²⁹ determined that foreign aid had a negative impact on economic growth. Yiew, T. & Lau, E.³⁰ found an initial negative impact in the short term but a positive impact over a longer period of time.

In this study, parallels will be drawn from past studies on effects on economic growth and applied to innovation.

²⁸ Ekanayake, E. M., Chatrna, D., “The Effect of Foreign Aid on Economic Growth in Developing Countries”, University of Florida (2010).

²⁹ Mallik, G., “Foreign Aid and Economic Growth: A Cointegration Analysis of the Six Poorest African Countries”, *Economic Analysis and Policy*, (2008), 38, 251-260.

³⁰ Yiew, T. H., & Lau, E., “Does Foreign Aid Contribute to or Impede Economic Growth”, *Journal of International Studies*, (2008), 11(3), 21-30.

3 Data and Methods

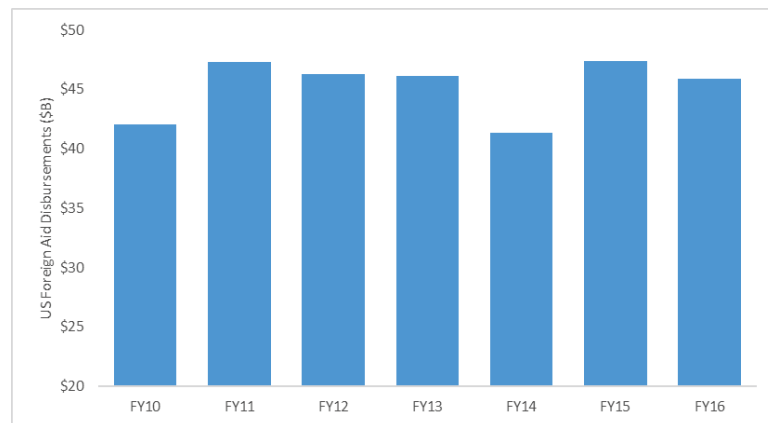
3.1 Data

The purpose of this research project is to examine the effect of US foreign aid (independent variable) on innovation (dependent variables) in recipient countries. The period covered in the research is FY 2010 - 2017. This range was selected to analyze the potential impacts of US foreign aid on innovation over time, in this case an 8-year period.

3.1.1. Independent Variables

US foreign aid data is sourced from the Foreign Aid Explorer, the official record of U.S. foreign aid (USAID).³¹ It is highly reliable and valid since it comes directly from a US government source, which follows consistent US government accounting and reporting practices. Figure 1, below shows the US Foreign Aid Disbursements from FY2010 to FY2016.

Figure 1 – US Foreign Aid Disbursements FY2010-2016



³¹ USAID, Foreign Aid Explorer | Data Download, <https://explorer.usaid.gov/data.html> (accessed October 15, 2018).

As shown in Figure 1, US foreign aid has consistently totaled over \$40B per year from FY10 to FY16. 239 countries received foreign aid disbursements to the tune of \$300B during this time period. The average yearly disbursement amount is \$45B while the median is \$46B. The lowest disbursement occurred in FY14 (\$41B) while the highest occurred in FY11 and FY15 (\$47B). The foreign aid disbursed each year is evaluated against the dependent variables in the following year. This lag is introduced to allow aid funds to be used and effects to be measured. The Foreign Aid Explorer also includes region information for each country (originally sources from the World Bank).

3.1.2. Dependent Variable

Innovation data is compiled from the annual Global Innovation Index reports published from 2011 through 2017³². 146 countries have been included in the rankings during this timeframe, though not all countries were included every year. The Global Innovation Index³³ is a framework for measuring nations' ability to innovate. It was created through a partnership between Cornell University, INSEAD, and the World Intellectual Property Organization. The consortium performs national innovation rankings on an annual basis. Each country's Global Innovation Index score is an average of the Innovation Input and Output sub-scores, which range from 0 (worst) to 100 (best).

The Innovation Input sub-score is calculated by consolidating various factors that enable innovation activity including:

³² Links to the Global Innovation Index reports are provided in Appendix A.

³³ Dutta, S., Lanvin, B., Wunsch-Vincent, S., "The Global Innovation Index 2018: Energizing the World with Innovation", *Cornell University, INSEAD, World Intellectual Property Organization*, (2018).

- Institutions – political, regulatory and business environments
- Human Capital and Research – education, research & development (R&D)
- Infrastructure - Information and communication technologies (ICTs), general infrastructure, ecological sustainability
- Market Sophistication – credit, investment, trade, competition & market scale
- Business Sophistication – knowledge workers, innovation linkages, knowledge absorption

Figure 2 – Median, Mean Innovation Input Scores 2011-2017 (Global Innovation Index)

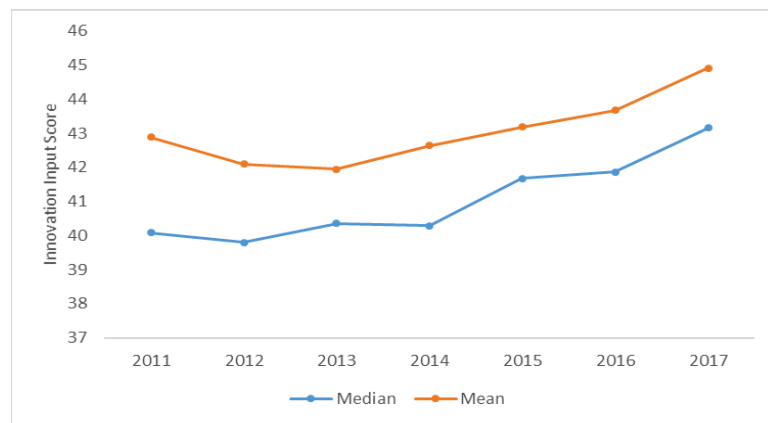


Figure 2 shows the median and mean Innovation Input sub-scores of 146 countries (unbalanced panel) evaluated on the Global Innovation Index from 2011 through 2017.

The figure shows a general uptick in both measures over the time period.

The main outputs of innovation activity that make up the Innovation Output sub-score are:

- Knowledge and Technology Outputs - Knowledge creation, impact and diffusion
- Creative Outputs - Intangible assets, creative goods and services, online creativity

Figure 3 – Median, Mean Innovation Output Scores 2011-2017 (Global Innovation Index)

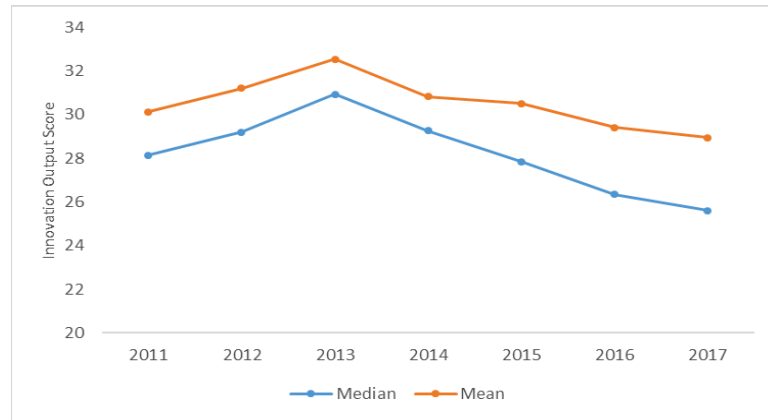


Figure 3 shows the median and mean Innovation Output sub-scores of 146 countries (unbalanced panel) evaluated on the Global Innovation Index from 2011 through 2017. This dataset includes both countries that received US foreign aid and countries that did not receive foreign aid. The figure shows a general decline in both measures over the time period. The effect of foreign aid on these Innovation Input and Output sub-scores was evaluated to determine the impact on overall innovativeness at the national level.

3.1.3 Control Variables

Many contributing variables have been incorporated into the Global Innovation Index. Two variables that may have impacts on innovation but are not accounted for are Gross Domestic Product (GDP) and population size. These are included as control variables in the analysis. The data is sourced from the World Bank data portal³⁴ and ranges from 2010 - 2016. GDP is included as a control variable to account for a country's access to its own resources to spur innovation activity.

³⁴ The World Bank, “World Bank Open Data”, <https://data.worldbank.org/> (accessed on October 1, 2018).

Population size is included to account for the wide variability across the countries included in the study.

3.2 Methods

Two linear models are compared to select the best model to assess the impact of US foreign aid on innovation. The methods are Panel Two-Way Fixed Effects and Panel Random Effects. These are expected to perform better than Ordinary Least Squares Regression as they reduce omitted variable bias in panel data. Both models have been used in past studies to assess the impact of foreign aid on economic growth and Foreign Direct Investment (FDI). The formula for Panel Two-Way Fixed Effects is depicted as:

$$\text{Innovation Score} = \beta_1 \text{ Foreign Aid}_{it} + \beta_2 \text{ Population Size}_{it} + \beta_3 \text{ GDP}_{it} + \beta_x (\text{Years})_t + \beta_y (\text{Countries})_i + u_{it}$$

For Random Effects, the formula is depicted as:

$$\text{Innovation Score} = \beta_1 \text{ Foreign Aid}_{it} + \beta_2 \text{ Population Size}_{it} + \beta_3 \text{ GDP}_{it} + \beta_y (1|\text{Countries})_i + u_{it}$$

Where β represents the coefficient on the independent and control variables, i is an index representing all instances of Country, t is the index representing the years (2010 – 2016) minus 1, and u is the error term.

4 Results

4.1 Effect of US Foreign Aid on Overall Innovativeness at the National Level

Table 1 summarizes the effect of US foreign aid on the Global Innovation Index of all countries receiving aid. It includes results from fixed effects and random effects regression models. A comparison with OLS regression results was also included to confirm that the Fixed Effects models were a better fit.

Table 1 Effects of Foreign Aid on Global Innovation Index Observed with OLS, Two-Way Fixed Effects and Random Effects Models

Variable	Model 1 OLS	Model 2 Two-Way Fixed Effects	Model 3 Random Effects
US Foreign Aid	-1.38e-09 (-1.53)	-6.63e-10 (-0.89)	-6.45e-10 (-0.87)
Population	-2.34e-08*** (9.05)	-3.89e-08* (-1.66)	-1.13e-08 (1.63)
GDP	6.59e-12*** (15.69)	1.75e-12** (2.42)	2.13e-12*** (3.55)
(Constant)	3.50e+01*** (92.63)	N/A	35.96*** (33.83)
Adjusted R-Squared	0.22	-0.19	0.03
# of Observations	911	911	911
# of Groups	145	145	145
Hausman Test (p-value)		0.01	
F Test (p-value)	< 2.2e-16		

Notes: The values in parenthesis represent the t-statistics. Significance codes: ***, ** and

* depict the statistical significance at 1%, 5% and 10% significance levels respectively.

As shown in Table 1, the Two-Way Fixed Effects model performed better than the regular OLS model. This is evidenced by the low p-value (less than 0.05) obtained from the F Test. In addition, a comparison of the Two-Way Fixed Effects and Random Effects (via Hausman Test) proved the Two-Way Fixed Effects to be the superior model. A closer look at results from the Two-Way Fixed Effects revealed that while the effects of the control variables (Population and GDP) were statistically significant at the 5% and 1% significance levels respectively, the effect of the independent variable (US Foreign Aid) was not significant. This suggests that US foreign aid has little effect on the Global Innovation Index across all countries receiving aid. Population was found to have a negative effect on the Global Innovation Index while GDP had a positive effect.

4.2 Effect of US Foreign Aid on Innovation Input Scores

Table 2 shows the analysis results from fixed effects, random effects and OLS regression models, this time assessing the effect of US foreign aid on the Innovation Input Score (a component of the Global Innovation Index which measures the conduciveness for innovation activity). As was the case with the Global Innovation Index (Table 1), Table 2 shows that the two-way fixed effects model outperformed both OLS and random effects models. Similarly, the impact of US foreign aid on the Innovation Input Score was statistically insignificant, suggesting that it has little effect on the Innovation Input Score. Unlike in Table 1, Population was the only variable that had a significant effect on the Innovation Input Score and this time it was a positive effect. This suggests that having more people enhances the conduciveness for innovation activity but does not guarantee Innovation Output.

Table 2 Effects of Foreign Aid on Innovation Input Score Observed with OLS, Two-Way Fixed Effects and Random Effects Models

Variable	Model 1 OLS	Model 2 Two-Way Fixed Effects	Model 3 Random Effects
US Foreign Aid	-2.28e-09** (-2.45)	-1.15e-09 (-1.42)	-1.73e-09** (-2.19)
Population	-2.86e-08*** (-10.60)	4.40e-08* (1.74)	6.21e-08 (0.64)
GDP	7.06e-12*** (16.15)	-9.68e-13 (-1.25)	1.29e-12* (1.95)
(Constant)	41.42*** (105.22)	N/A	41.83*** (26.88)
Adjusted R-Squared	0.23	-0.19	0.02
# of Observations	911	911	911
# of Groups	145	145	145
Hausman Test (p-value)		3.78e-12	
F Test (p-value)	< 2.2e-16		

Notes: The values in parenthesis represent the t-statistics. Significance codes: ***, ** and * depict the statistical significance at 1%, 5% and 10% significance levels respectively.

This was supported in the analysis of the effect of US foreign aid on the Innovation Output Index (Table 3). Table 3 shows that the effect of US foreign aid on the Innovation Output Index is statistically insignificant but Population and GDP had statistically significant effects. These same effects were observed with the Global Innovation Index, While Population had a negative effect, GDP had a positive effect. Similarities between Tables 1 and 3 imply that the effect observed on the Global Innovation Index are largely due to the effect on the Innovation Output Index.

Table 3 Effects of Foreign Aid on Innovation Output Score Observed with OLS, Two-Way Fixed Effects and Random Effects Models

Variable	Model 1 OLS	Model 2 Two-Way Fixed Effects	Model 3 Random Effects
US Foreign Aid	-5.13e-10 (-0.54)	-6.97e-10 (-0.61)	1.50e-11 (0.01)
Population	-1.83e-08*** (-6.71)	-1.26e-07*** (-3.52)	-3.80e-088** (-2.37)
GDP	6.11e-12*** (13.83)	4.51e-12*** (-4.10)	2.06e-12** (2.02)
(Constant)	28.61*** (71.88)	N/A	30.89*** (11.73)
Adjusted R-Squared	0.18	-0.17	0.01
# of Observations	911	911	911
# of Groups	145	145	145
Hausman Test (p-value)		< 2.2e-16	
F Test (p-value)	< 2.2e-16		

4.3 The Region Effect

Additional analysis was conducted to establish the effect of US foreign aid on innovativeness by segmenting receiving countries into their geographic regions (as defined by USAID and used by multiple government agencies and multilateral organizations). The regions were: 1) East Asia and Oceania 2) Europe and Eurasia 3) Middle East and North Africa 4) Sub-Saharan Africa 5) South and Central Asia and 6) Western Hemisphere. Significant findings were noted for Europe and Eurasia.

4.1.1. Europe and Eurasia

As shown in Table 4, US foreign aid was found to have a negative, statistically significant effect on the Innovation Input Score for countries in Europe and Eurasia who

receive the aid. On average, the Innovation Input Score would decrease by 5 points over an approximate 10-year period if aid were to increase by significant levels. Additional analysis is needed to understand what the aid is used for since 65% of countries in this category are in the high income level. It is plausible that a significant increase in aid to these countries would indicate these countries are in a major economic downturn and hence require the additional assistance. In that case, innovation would not be the main focus of the funding.

Table 4 Effect of US Foreign Aid on Innovation Scores for Countries in Europe and Eurasia (Two-Way Fixed Effects)

Variable	Global Innovation Index	Innovation Input Score	Innovation Output Score
US Foreign Aid	-2.089e-09 (-0.87)	-4.81e-09** (-2.21)	6.22e-10 (0.15)
Population	8.04e-07*** (3.17)	8.61e-07*** (3.72)	7.48e-07* (1.67)
GDP	6.96e-13 (13.83)	-4.31e-12 (-1.36)	5.7e-12 (2.02)
Adjusted R-Squared	-0.12	-0.12	-0.17
# of Observations	283	283	283
# of Groups	44	44	44
F-Statistic (p-value)	0.0002	0.0001	0.02

Population was found to have a positive, statistically significant effect on all 3 innovation scores. This suggests that over time, innovation scores would increase by 7-8 points over a 10-year period if population were to continue to increase. This may indicate

that the work force in these countries would have the skills and inclination to engage in innovation activities and ensure successful outcomes.

4.1.2. Middle East and North Africa

Table 5 depicts the effects of US Foreign aid on innovation scores or countries in the Middle East and North Africa. As shown, US foreign aid was found to have statistically insignificant effects on the innovation scores. Population size was found to have a significant effect on the Global innovation index. This suggests that over time, innovation scores would increase by 7 points over a 10-year period if population were to continue to increase.

Table 5 Effect of US Foreign Aid on Innovation Scores for Countries in the Middle East and North Africa

(Two-Way Fixed Effects)

Variable	Global Innovation Index	Innovation Input Score
US Foreign Aid	-7.54e-10 (-0.56)	-7.19e-10 (-0.63)
Population	4e-07* (1.86)	2.55e-07 (1.39)
GDP	2.52e-11* (1.96)	2.39e-11* (2.17)
Adjusted R-Squared	-0.14	-0.15
# of Observations	104	104
# of Groups	15	15
F-Statistic (p-value)	0.02	0.03

Similar to the countries in the Europe and Eurasia region, this may indicate that the work force in the Middle Eastern and North American countries are primed skill-wise and are motivated to engage in innovation activities and ensure successful outcomes.

Interestingly, another significant influencer on innovation in Middle Eastern and North American countries is their GDP. This may be explained by the fact that 53% of the countries in this region are in the middle income category and have room to grow their economies. The effect of GDP on innovation may taper off as improvements to these countries' economies approach those of high income level countries.

5 Conclusion

The importance and efficacy of US foreign aid has recently been brought into question by the Trump administration. Previous works have studied the impact of foreign aid on economic growth with mixed results. US foreign aid promotes peace, security, and economic development, and provides humanitarian relief. These factors also spur innovation. It was therefore reasonable to expect that increased innovation would also be a bi-product of foreign aid. The conclusion from the study is that for countries in Europe and Eurasia, US foreign aid has a negative impact on the factors that drive the Global Innovation Index's innovation input sub-score. The innovation input factors include:

- Institutions – political, regulatory and business environments
- Human Capital and Research – education, research & development (R&D)
- Infrastructure - Information and communication technologies (ICTs), general infrastructure, ecological sustainability
- Market Sophistication – credit, investment, trade, competition & market scale

- Business Sophistication – knowledge workers, innovation linkages, knowledge absorption

The result was the opposite of what was expected. Additional analysis is needed to understand what the aid is used for since 65% of countries in this category are in the high income level. It is plausible that a significant increase in aid to these countries would indicate that these countries are in a major economic downturn and hence require the additional assistance. In that case, innovation would not be the main focus of the funding. The results add to the literature on the effects of foreign aid and will provide useful insight in future considerations about how and when the US provides aid to other countries. It will also serve as a basis for future research on related topics.

In other regions, US foreign aid does not have a significant effect on the Global Innovation Index or the input and output sub-scores. GDP and population size, on the other hand, do have measurable impacts on innovation under various scenarios. For example, when observing all countries regardless of geographic region, population is found to have a negative effect on the overall Global Innovation Index, while GDP has a positive effect. A further examination shows that population has a positive effect on the Innovation Input Score. This suggests that having more people may enhance the conduciveness for innovation activity (but does not necessarily guarantee Innovation Output). An examination of the effects of GDP and population on the Innovation Output Score shows that GDP has a positive effect while population had a negative effect. The similarities between the effects of GDP and population on the Global Innovation Index and the Innovation Output sub-scores suggests that the effects on Global Innovation Index may be driven by the effect on the Innovation Output score.

5.1 Research Limitations

This research focused on the effects of US foreign aid on innovation in recipient countries, specifically to contribute to recent discourse about the need for aid to those countries. It is however known that many countries receive aid from multiple donors, not just the US. It is possible that the true effects of foreign aid on innovation were obscured due to the focus on the US part of aid to recipient countries. Perhaps, a different outcome would have been achieved if complete foreign aid data had been available on the countries included in this study (those that receive aid from the US and are also included in the annual Global Innovation Index reports).

5.2 Recommendations for Future Research

Further research is recommended to examine the effect of all foreign aid (not just US aid) on innovation in recipient countries when the data becomes available. Also, since population and GDP were found to have mixed effects on innovation, further research is recommended with population and GDP as the independent variables. This will provide insight into the nature of the impacts of these variables on innovation.

6 References

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Appendix A

Global Innovation Index Reports 2011 - 2017

GII 2017 <http://www.wipo.int/publications/en/details.jsp?id=4193>

GII 2016 <http://www.wipo.int/publications/en/details.jsp?id=4064>

GII 2015 <http://www.wipo.int/publications/en/details.jsp?id=3978>

GII 2014 <http://www.wipo.int/publications/en/details.jsp?id=3254>

GII 2013 <http://www.wipo.int/publications/en/details.jsp?id=368>

GII 2012 <http://www.wipo.int/publications/en/details.jsp?id=247>

GII 2011 <http://www.wipo.int/publications/en/details.jsp?id=274>

Curriculum Vita

Angelina H. Boampong is an M.S. candidate in Government Analytics program at Johns Hopkins University. She received her B.S. in Biochemistry from the University of Science and Technology (Ghana) and a M.S in Management Information Systems from Bowie State University (Maryland). Angelina has over 15 years of experience in program/project management, software development, business intelligence and systems implementation. Her research interests are in the fields of innovation and management science.